

ABSTRACT:

Title : Interplanetary magnetic field guiding relativistic particles

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Abstract: The origin and the propagation of relativistic solar particles (0.5 to few GeV) in the interplanetary medium remains a debated topic. These relativistic particles, detected at the Earth by neutron monitors have been previously accelerated close to the Sun and are guided by the interplanetary magnetic field (IMF) lines, connecting the acceleration site and the Earth. Usually, the nominal Parker spiral is considered for ensuring the magnetic connection to the Earth. However, in most GLEs the IMF is highly disturbed, and the active regions associated to the GLEs are not always located close to the solar footprint of the nominal Parker spiral.

A possible explanation is that relativistic particles are propagating in transient magnetic structures, such as Interplanetary Coronal Mass Ejections (ICMEs).

In order to check this interpretation, we studied in detail the interplanetary medium where the particles propagate for 10 GLEs of the last solar cycle.

Using the magnetic field and the plasma parameter measurements (ACE/MAG and ACE/SWEPAM), we found widely different IMF configurations. In an independent approach we develop and apply an improved method of the velocity dispersion analysis to energetic protons measured by SoHO/ERNE. We determined the effective path length and the solar release time of protons from these data and also combined them with the neutron monitor data.

We found that in most of the GLEs, protons propagate in transient magnetic structures. Moreover, the comparison between the interplanetary magnetic structure and the interplanetary length suggest that the timing of particle arrival at Earth is dominantly determined by the type of IMF in which high energetic particles are propagating. Finally we find that these energetic protons are not significantly scattered during their transport to Earth.
